

Bureau of Bridge Design
Tel: (603) 271-2731
October 1, 2004

Bridge Design Consulting Firms

**Re: 1) NHDOT Live Load Deflection Criteria
2) High Performance Steel
3) Precast Prestressed Concrete Deck Panels**

Dear Consultant:

The purpose of this letter is to inform you of recent decisions by the NHDOT Bridge Design Bureau regarding the above referenced subjects that affect your bridge design work for the Department.

1. **Live load deflection criteria** - As you are likely aware, the AASHTO Standard Specifications suggest L/800 (w/o sidewalk) and L/1000 (w/ sidewalk) as the limits of live load deflection. For many years the Bridge Design Bureau has required the more conservative limits of L/1200 (w/o sidewalk) and L/1600 (w/ sidewalk) as the live load deflection criteria. Members of Bridge Design and FHWA have had several discussions regarding these conservative limits and the NHDOT Research Advisory Committee recently approved funding to study this issue further in the months ahead.

There is considerable research that suggests that the vibrations felt on a bridge as trucks travel over it are more a result of the structure's inherent natural frequency than a result of the live load deflection. In short, vibrations may not directly correspond to deflection of the superstructure. Consequently, our conservative L/1200 and L/1600 ratios are not necessarily providing the Department with structures having reduced vibration. This applies to bridges both with and without a sidewalk. Since stricter deflection limits do not necessarily equate to reduced vibrations and improved pedestrian comfort, it is considered more appropriate to have single deflection criteria for all situations. The AASHTO LRFD Design Specifications no longer include a specific requirement or check of the live load deflection. However, the Department also believes that the stiffness of structures, which is a factor in determining their natural frequencies and may correlate to the deflection limits, could have implications for the long-term durability of concrete bridge decks.

This issue is especially pertinent when considering the additional steel and cost that results from a steel design according to the NHDOT Bridge Design Manual, as compared to a steel design according to the AASHTO Standard Specifications. Basically, designs per our present conservative deflection criteria require more steel and thus are more expensive. These structures designed according to the L/1200 and L/1600 ratios result in a load rating well in excess of the HS25 design loading, occasionally more than twice the required design capacity.

Based on the above referenced information, Bridge Design has decided to relax the live load deflection requirements. From this point forward, you are instructed to perform bridge design efforts using an HS25 loading and a L/1000 ratio to calculate and check the live load deflection. As our investigation into this issue progresses, further revisions may be warranted.

2. **High Performance Steel** – To date, the Department has constructed only one bridge utilizing 70W HPS. The design of this structure, NH Route 111 By-Pass over Flatrock Brook in Windham, provided the opportunity to perform several design comparisons. Various steel framing configurations and live load combinations were analyzed to evaluate the potential effects on the cost and rating of the structure. (This information was presented at the AASHTO T-14 Steel Design Technical Committee meeting held in Manchester during April 2003.)

Industry information available on 70W HPS demonstrates that it is a cost effective and structurally efficient material, readily available, with improved structural properties as compared to the 50 ksi steel more commonly used. Fabrication, availability, and weldability issues have been resolved, although it is still somewhat more expensive than 50 ksi steel. However, the use of 70W HPS, especially for longer spans and hybrid girders, results in a design that is more efficient and less costly.

Another fact supported by the HPS comparison was that the L/1200 and L/1600 live load deflection criteria specified in the NHDOT Bridge Design Manual basically negated most benefits that might be recognized by constructing a hybrid HPS girder. These criteria generally result in a structure that is controlled by deflection and not by stress. Thus, the benefits of using HPS would only be economical if our conservative deflection criteria were changed.

Since we have now relaxed the live load deflection criteria (as noted in #1 above), you are now requested to consider 70W HPS (Grade 70 ksi) as appropriate when designing steel bridges to develop the most efficient and economical configuration of the steel members. Obviously, this should not be taken to extremes and good design practice as well as common sense should be considered. In addition, increases in design hours to evaluate/incorporate HPS will not be accepted. It is expected that the evaluation and use of HPS will become simply another standard task during design, similar to spacing and sizing the steel girders, flanges, and webs.

3. **Precast prestressed concrete deck panels (partial depth)** – Members of Bridge Design have been directly involved with developing acceptable/workable details for the fabrication and use of precast deck panels. Recently completed research indicates that the use and performance of these panels is acceptable for multi-span structures, regardless of traffic volume or loads, in accordance with the other guidelines described in the NHDOT Bridge Design Manual.

You are hereby informed that precast prestressed partial depth concrete deck panels should now be included as a “Contractor’s Option” for multi-span structures regardless of traffic volume or loads, unless specifically prohibited by the Department. However, please keep in mind that all other conditions as listed in the NHDOT Bridge Design Manual must be met to allow this option. For example, precast concrete deck panels are still not allowed on bridges having deck cross-slopes of 4% or greater, or on bridges with horizontally curved girders, unless specifically allowed by the Department. Current details may be obtained from Bridge Design for use in developing contract plans.

In summary, the application of live load deflection requirements, the use of high performance steel (70W HPS), and precast concrete deck panels have been revised by the NHDOT Bridge Design Bureau, as outlined above. These changes should be applied to all projects for which the design status of the project indicates that such changes would be beneficial. As further research and/or information becomes available, these changes may be revised further, or even eliminated altogether, as determined by Bridge Design.

Thank you for your cooperation with implementing these changes. Should you have any questions or if you need additional information, please feel free to contact me as needed.

Sincerely,

(Signed)

Mark W. Richardson, PE
Administrator, Bridge Design

MWR

cc: J. Moore, J. Brillhart, L. Knowlton
Bridge Design, Bridge Maintenance
D. Hall (FHWA)

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